

FORM-PTO-1390 (Rev. 9-2001)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER  029777-008	
<b>TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371</b>				U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5) Unpublished <b>10/049880</b>	
INTERNATIONAL APPLICATION NO. PCT/DE00/02800		INTERNATIONAL FILING DATE August 17, 2000		PRIORITY DATE CLAIMED August 19, 1999	
TITLE OF INVENTION SEMI-FINISHED AND FINISHED PRODUCTS MADE OF AUSTENITIC SPECIAL STEEL, AND METHOD FOR THE MANUFACTURE THEREOF					
APPLICANT(S) FOR DO/EO/US Heinrich FRIEDERICH and Reinhard SCHMOOK					
<p>Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:</p> <ol style="list-style-type: none"> <li>1. <input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li>2. <input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li>3. <input checked="" type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below</li> <li>4. <input checked="" type="checkbox"/> The US has been elected by the expiration of 19 months from the priority date (Article 31).</li> <li>5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))           <ol style="list-style-type: none"> <li>a. <input checked="" type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau).</li> <li>b. <input type="checkbox"/> has been communicated by the International Bureau.</li> <li>c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</li> </ol> </li> <li>6. <input checked="" type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2))           <ol style="list-style-type: none"> <li>a. <input checked="" type="checkbox"/> is attached hereto.</li> <li>b. <input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4).</li> </ol> </li> <li>7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))           <ol style="list-style-type: none"> <li>a. <input checked="" type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau).</li> <li>b. <input type="checkbox"/> have been communicated by the International Bureau.</li> <li>c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</li> <li>d. <input type="checkbox"/> have not been made and will not be made.</li> </ol> </li> <li>8. <input checked="" type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</li> <li>9. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</li> <li>10. <input type="checkbox"/> An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</li> </ol> <p><b>Items 11 to 20 below concern document(s) or information included:</b></p> <ol style="list-style-type: none"> <li>11. <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</li> <li>12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.</li> <li>13. <input checked="" type="checkbox"/> A FIRST preliminary amendment</li> <li>14. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.</li> <li>15. <input type="checkbox"/> A substitute specification.</li> <li>16. <input type="checkbox"/> A change of power of attorney and/or address letter.</li> <li>17. <input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.</li> <li>18. <input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4).</li> <li>19. <input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).</li> <li>20. <input checked="" type="checkbox"/> Other items or information:</li> </ol> <p style="margin-top: 10px;">Verification of Translation, International Search Report and English translation, amended claim replacement sheets and English translation</p>					



**21839**

U.S. APPLICATION NO. (If known, see 27 C.F.R. 1.51) <b>Unassigned</b>	INTERNATIONAL APPLICATION NO. <b>PCT/DE00/02800</b>	ATTORNEY'S DOCKET NUMBER <b>029777-008</b>
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10/049880

21. <input checked="" type="checkbox"/> The following fees are submitted:	<b>CALCULATIONS</b>	PTO USE ONLY			
<b>Basic National Fee (37 CFR 1.492(a)(1)-(5)):</b> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO ..... \$1,040.00 (960) International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... \$890.00 (970) International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$740.00 (958) International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... \$710.00 (956) International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) ..... \$100.00 (962)					
<b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b>	<b>\$ 890.00</b>				
Surcharge of <b>\$130.00 (154)</b> for furnishing the oath or declaration later than months from the earliest claimed priority date (37 CFR 1.492(e)).      20 <input type="checkbox"/> 30 <input type="checkbox"/>					
Claims	Number Filed	Number Extra	Rate		
Total Claims	12 -20 =	0	X\$18.00 (966)	\$ 0	
Independent Claims	2 -3 =	0	X\$84.00 (964)	\$ 0	
Multiple dependent claim(s) (if applicable)			+ \$280.00 (968)	\$ 0	
<b>TOTAL OF ABOVE CALCULATIONS =</b>				<b>\$ 890.00</b>	
Reduction for 1/2 for filing by small entity, if applicable (see below).      +				\$ 0	-
<b>SUBTOTAL =</b>				<b>\$ 890.00</b>	
Processing fee of <b>\$130.00 (156)</b> for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492(f)).      20 <input type="checkbox"/> 30 <input type="checkbox"/>			+	\$ 0	
<b>TOTAL NATIONAL FEE =</b>				<b>\$ 890.00</b>	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). <b>\$40.00 (581)</b> per property      +				\$ 0	
<b>TOTAL FEES ENCLOSED =</b>				<b>\$ 890.00</b>	
				<b>Amount to be refunded:</b>	\$
				<b>charged:</b>	\$

a. ☐ Small entity status is hereby claimed.

b. ☒ A check in the amount of \$ 890.00 to cover the above fees is enclosed.

c. ☐ Please charge my Deposit Account No. 02-4800 in the amount of \$ \_\_\_\_\_ to cover the above fees. A duplicate copy of this sheet is enclosed.

d. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 02-4800. A duplicate copy of this sheet is enclosed.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.**

SEND ALL CORRESPONDENCE TO:

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SIGNATURE  
**Scott W. Cummings**  
 NAME  
 41,567  
 REGISTRATION NUMBER  
 February 19, 2002  
 DATE

Patent  
Attorney's Docket No. 029777-008

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Patent Application of	)	
	)	
Heinrich FRIEDERICH et al.	)	Group Art Unit: Unassigned
	)	
Application No.: PCT/DE00/02800	)	Examiner: Unassigned
	)	
Filed: August 17, 2000	)	
	)	
For: SEMI-FINISHED AND FINISHED	)	
PRODUCTS MADE OF	)	
AUSTENITIC SPECIAL STEEL,	)	
AND METHOD FOR THE	)	
MANUFACTURE THEREOF	)	

**PRELIMINARY AMENDMENT**

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

Prior to examination of the above-identified application, please amend the claims of published PCT application PCT/DE00/02800, as specified below.

**IN THE ABSTRACT:**

*Please add the Abstract attached hereto as a separate sheet.*

**IN THE CLAIMS:**

*Please replace claims 1-12 with the corresponding amended claims.*

1. (Amended) Semi-finished and finished products in the form of sheets, profiles or shafts made of corrosion-resistant, precipitation hardenable, austenitic special steel with a high interstitially dissolved nitrogen content, with substantially smooth

surfaces, wherein the steel material is precipitation hardened in a zoned manner, and the steel has a chemical composition comprising:

C 0.08-0.115 %;

Mn 1.5-4 %;

Mo 0.3-1.5 %;

Cr 17.5-20 %;

Ni 10-13 %; and

N 0.2-0.5 %

wherein the remainder is substantially composed of iron.

2. (Amended) Semi-finished and finished products according to claim 1, wherein the steel material is inductively precipitation hardened in a zoned manner.

3. (Amended) Semi-finished and finished products according to claim 1, wherein they are at least partly hardened in a surface layer, wherein the thickness of the precipitation hardened layer is less than 50 %, preferably less than 30 % and in particular less than 10 % of the material thickness measured perpendicular to the surface.

4. (Amended) Semi-finished and finished products according to claim 1, wherein they are either sheets or profile rods with a substantially constant cross-section over their length.

—

wherein the remainder is substantially composed of iron, in that the material worked in the still hot, or re-heated state into semi-finished and finished products with a substantially smooth surface, and as required can also be cold-worked, and in that subsequently a precipitation hardening treatment is undertaken that affects at the most a part of the volume of the semi-finished and/or finished products.

9. (Amended) Method according to claim 8, wherein inductive precipitation hardening treatment is undertaken in a temperature range of 300°C to 550°C.

10. (Amended) Method according to claim 8, wherein inductive precipitation hardening treatment is undertaken such that the precipitation hardening only occurs in a surface layer with a layer thickness of 0.5 mm at the most.

11. (Amended) Method according to claim 8, wherein the material is substantially endless material or rod material or respectively sheet material that is passed continuously through an induction apparatus.

12. (Amended) Method according to claim 8, wherein instead of inductive treatment, precipitation hardening is done by laser irradiation.

Application No. PCT/DE00/02800

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*Please cancel claims 13-15 without prejudice or disclaimer.*

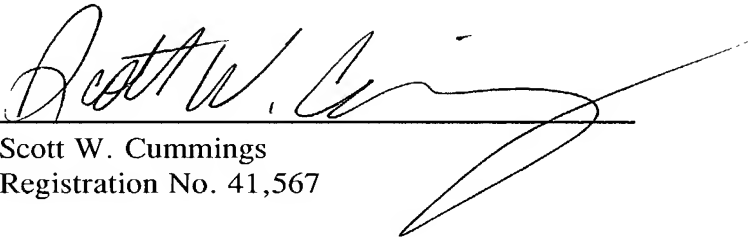
REMARKS

The amendments to the claims were made to remove multiple dependencies and place the claims in proper form. No new matter has been added. An Abstract is attached.

Early examination and allowance of claims 1-12, is respectfully requested.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

By:   
\_\_\_\_\_  
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Date: February 19, 2002

**Attachment to Preliminary Amendment dated February 19, 2002**

**Marked-up Claims 1-12**

1. (Amended) Semi-finished and finished products in the form of sheets, profiles or shafts made of corrosion-resistant, precipitation hardenable, austenitic special steel with a high interstitially dissolved nitrogen content, with substantially smooth surfaces, [characterised in that] wherein the steel material is precipitation hardened in a zoned manner, and [in that] the steel has a chemical composition comprising [within the following ranges]:

C     0.08-0.115%;

Mn   1.5-4%;

Mo   0.3-1.5%;

Cr   17.5-20%;

Ni   10-13%; and

N     0.2-0.5%

wherein the remainder is substantially composed of iron.

2. (Amended) Semi-finished and finished products according to claim 1, [characterised in that] wherein the steel material is inductively precipitation hardened in a zoned manner.



**Attachment to Preliminary Amendment dated February 19, 2002**

**Marked-up Claims 1-12**

3. (Amended) Semi-finished and finished products according to claim 1 [or 2], [characterised in that] wherein they are at least partly hardened in a surface layer, wherein the thickness of the precipitation hardened layer is less than 50%, preferably less than 30% and in particular less than 10% of the material thickness measured perpendicular to the surface.

4. (Amended) Semi-finished and finished products according to [one of claims 1 to 3] claim 1, [characterised in that] wherein they are either sheets or profile rods with a substantially constant cross-section over their length [the steel has a chemical composition within the following ranges:

C 0.02-0.12%

Mn 1-16%

Mo 0-3%

Cr 16-26%

Ni 0-15%

N 0.2-0.9%

wherein the remainder is substantially composed of iron].

**Attachment to Preliminary Amendment dated February 19, 2002**

**Marked-up Claims 1-12**

5. (Amended) Semi-finished and finished products according to [one of claims 1 to] claim 4, [characterised in that] wherein the profile cross-section is circular, elliptical, quadratic, hexagonal, octagonal, L-shaped, cross-shaped, U-shaped or double T-shaped [the steel has a chemical composition within the following ranges:

C 0.08-0.115%

Mn 1.5-4%

Mo 0.3-1.5%

Cr 17.5-20%

Ni 10-13%

N 0.2-0.5%

wherein the remainder is substantially composed of iron].

6. (Amended) Semi-finished and finished products according to [one of claims 1 to] claim 5, [characterized in that] wherein [they are either sheets or profile rods] the steel material is a sheet or a plate with [a] substantially constant [cross-section over their length] material thickness.

wherein the remainder is substantially composed of iron, in that the material worked in the still hot, or re-heated state into semi-finished and finished products with a substantially smooth surface, and as required can also be cold-worked, and in that subsequently a

**Attachment to Preliminary Amendment dated February 19, 2002**

**Marked-up Claims 1-12**

precipitation hardening treatment is undertaken that affects at the most a part of the volume of the semi-finished and/or finished products.

9. (Amended) [Finished product according to one of claims 1 to 5, characterised in that it is a shaft with a diameter that varies along its axial length] Method according to claim 8, wherein inductive precipitation hardening treatment is undertaken in a temperature range of 300°C to 550°C.

10. (Amended) Method [for manufacturing semi-finished and finished products from corrosion-resistant, precipitation hardenable, austenitic special steel with a high interstitially dissolved nitrogen content, characterised in that a steel material with the following chemical composition is firstly manufactured:

C	0.02-0.12%
Mn	1-16%
Mo	0-3%
Cr	16-26%
Ni	0-15%
N	0.2-0.9%

wherein the remainder is substantially composed of iron, in that the material worked in the still hot, or re-heated state, and as required can also be cold-worked, and in that

12. (Amended) Method according to claim 8 [10], [characterised in that] wherein [inductive precipitation hardening treatment is undertaken such that the precipitation hardening only occurs in a surface layer with a layer thickness of 0.5 mm at the most] instead of inductive treatment, precipitation hardening is done by laser irradiation.

[illegible]Application No. PCT/DE00/02800Attorney's Docket No. 029777-008

## ABSTRACT OF THE DISCLOSURE

The invention relates to semifinished and finished products made from special corrosion-resistant precipitation-hardened austenitic steel containing a large amount of interstitially dissolved nitrogen, comprising substantially smooth surfaces. The invention also relates to a method for producing corresponding semifinished and finished items. The aim of the invention is to produce semifinished and finished items and to provide an economical method for the production thereof, combining both solidity and resistance to corrosion. This is achieved by precipitation-hardening areas of the steel material.

Semi-finished and finished products made of austenitic special steel,  
and method for the manufacture thereof

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Priority: German Utility Patent No. 299 14 269 of 19.08.1999

5 German Utility Patent No. 299 14 802 of 24.08.1999

German Utility Patent No. 299 16 517 of 15.09.1999

German Utility Patent No. 299 21 121 of 01.12.1999

German Utility Patent No. 299 21 813 of 12.12. 1999

10 The present invention relates to semi-finished and finished products manufactured from corrosion-resistant precipitation hardenable austenitic special steel with a high content of interstitially dissolved nitrogen, with substantially smooth surfaces. The present invention also relates to a method for manufacturing corresponding semi-finished and finished products.

15 Within the framework of the present description, semi-finished and finished products with substantially smooth surfaces are understood as semi-finished and finished steel products, the dimensions of corresponding surface structures are to some extent comparable with the dimensions of the material itself, that is to say in particular with the thickness of the material, in contrast to components such as, for example, screws,  
20 which are to be considered as sharply notched components. In particular, in the case of the articles to which the present invention relates, corresponding structures are typically in the region of clearly more than 1 mm. The present invention mainly extends to profile parts and/or sheets, that is to say to parts having a substantially constant profile over their length, be this delimited by a circular, elliptic, polygonal or  
25 a more or less irregular contour. In the case of profiled rods, the material thickness should as a rule be more than 1 mm, and in the case of sheets more than 0.2 mm.

Many special steel components have great requirements placed upon them with respect to strength and corrosion resistance. Typical examples of such components are tension

rods, tie rods, supports, pipes, sleeves, sheets, profiles with different cross-sections and so forth. Other components with variable cross-sections such as, for example, shafts, which have different, graduated diameters in some areas, have to satisfy great requirements with respect to corrosion resistance and strength. The present invention  
5 is directed towards such articles.

Semi-finished and finished products of this type made from austenitic corrosion-resistant special steel firstly generally obtain their strength by means of multiple cross-section reduction by cold rolling, selectively with or without intermediate solution annealing treatment. Lastly, for suitable components heat treatment in a furnace, a  
10 precipitation hardening, typically in a nitrogen atmosphere, takes place. There is, nevertheless the risk of chromium carbide precipitation, which leads to reduction of the corrosion resistance and increase in the risk of inter-crystalline corrosion. Moreover, heat treatment in the furnace inevitably causes precipitation hardening over the entire volume of material. A partial increase in the strength of specific component  
15 areas is thus not possible. Precipitation hardening in the furnace is extraordinarily time and cost-intensive, and increases the price of the corresponding products by several times as much.

Appropriate substances are described, for example, in European Patent No. 545 852 B1, and European Patent Application 774 589 A1.

20 The present application takes priority from German Utility Patent Nos. 299 14 269, 299 14 802, 299 16 517, 299 21 121 and 299 21 813, the contents of which are incorporated herein in their entirety by this reference to them.

A self-tapping screw made from corrosion-resistant material is known from DE-OS 198 15 670 that is inductively hardened in the lower cutting and thread area. With such  
25 screws, the hardened structures nevertheless form very fine and relatively thin-walled surface structures that have been subjected to a significant micro-structural change (work-hardening) in an earlier cold-working, so in this case inductive precipitation hardening found successful application as it was substantially limited to the threads only.



With respect to this prior art, the object of the present invention is to provide semi-finished and finished products and a method for their manufacture, that obtain a particularly advantageous combination of strength and corrosion-resistance with inexpensive manufacture.

- 5 This object is solved in that the steel material is precipitation hardened in a zone-wise manner.

Precipitation hardening is preferably done inductively, wherein alternatively laser irradiation is also conceivable.

- 10 The method for inductive precipitation hardening (or done by laser irradiation) has the substantial advantage that the areas and also the layer thickness within which precipitation hardening takes place can be completely, purposely selected. In this way strength and corrosion-resistance can be optimised by area, as generally the areas hardened by precipitation tend to be somewhat more susceptible to corrosion, but on the other hand have greater strength.

- 15 It has been shown, nevertheless, that inductive hardening is unexpectedly possible for the articles under discussion here, even though this appeared problematic for austenitic steels. This hardening method is possible in particular for austenitic steels with the composition (percentages by weight) set out in claim 4. Properties with respect to the combination of strength and corrosion-resistance are particularly advantageous when  
20 the ranges of composition according to claim 6 are followed. In the preferred variations the amounts of the components set out in detail in claims 4 and 5 respectively are coordinated with one another such that the remaining quantity of iron is between 65 and 68%.

- 25 By means of these alloy quantities, the steel obtains a good degree of corrosion-resistance, comparable with A2 qualities. The limiting of the nitrogen content corresponds to its natural solubility in austenite, which increases with increased manganese content. Together with inductive precipitation hardening, the upper carbon content limit largely prevents formation of chromium carbide, which would preferably adapt itself to grain size, and lessens susceptibility to inter-crystalline corrosion.

The substance can be formed, in the manner usual for austenitic special steel alloys, by rolling or drawing into the desired final measurements, wherein in order to obtain the highest degree of strength, the course of fabrication has to be set out such that after the hot working or solution annealing treatment (solution annealing and quenching  
5 eliminates the hardening caused by cold working), cross-section reduction > 40% by cold working has to be planned.

By means of this cold working, because of cold hardening and work-induced formation of martensite, strengths of  $R_m = 1800 \text{ Mpa}$  can occur.

Subsequent inductive precipitation treatment that is undertaken in the temperature  
10 range of  $300^\circ\text{C} < T < 550^\circ\text{C}$  leads to formation of intermetallic phases. These are mainly nitrides and/or to a small extent carbides, that lead to the desired increase in strength and hardness respectively, of up to 30%, in particular in the structural areas that have already been most greatly strengthened and transformed by mechanical working. Limitation of the corrosion properties is not to be expected.

15 This heat treatment alone (in addition to laser irradiation that also has to be borne in mind) permits partial increase in strength in defined cross-section areas.

Because of the extremely short heat treatment times (several seconds), inductive precipitation hardening permits a clear price advantage compared to the components conventionally treated by several hours of furnace heating.

20 By means of the invention, articles with substantially smooth surfaces and a diameter greater than 1 mm are provided, that have both an advantageous raw material price – comparable with the known A2 qualities – with good corrosion-resistance properties, as well as selectively having a high degree of strength/hardness over the entire length or in some areas over the length or the cross-section.

25 With respect to the shapes and profile cross-sections, the articles according to the invention can vary in wide ranges. Profile parts in the shape of sheets, rods or also wires, that can be passed continuously through an inductive treatment are preferred.

Further advantages, features and possibilities for application of the present invention

will be evident from the following description of preferred embodiments and the attached drawings.

There is shown, in:

- Figure 1            a profile part with a quadratic cross-section,
- 5    Figure 2            a profile part with L-shaped cross-section,
- Figure 3            a profile part with the cross-section of a regular octagon,
- Figure 4            a profile part with a U-shaped cross-section,
- Figure 5            a profile part with a cross-shaped cross-section,
- Figure 6            a profile part with a double T cross-section, and
- 10    Figure 7            different views of a shaft manufactured from the steel material according to the invention.

In Figures 1 to 6, different profile parts are shown that differ substantially in their cross-section, which however remain constant in the case of the respective profile part over their length, wherein the length of the profile parts can in principle, be as desired.

- 15    For practical purposes, such profile parts typically have lengths of approximately 6 m, but if they are sufficiently flexible they can also be wrapped into rolls and are then transportable in significantly greater lengths. Clearly, hollow profiles such as, for example, pipes, with the greatest variation of cross-section shapes can also be manufactured with the features according to the invention.

- 20    In the case of the profile parts shown, the longitudinal edge, sharp corner areas can be more or less greatly rounded off. Precipitation hardening of the parts is done inductively and can thus be selectively limited to areas as desired, that is to say to different longitudinal sections and to different cross-section areas.

- 25    Hardening is preferably done in a surface layer, the total cross-section of which comprises between 1 and 50% of the total profile cross-section, or respectively the wall thickness of the steel material.

Inductive precipitation hardening of components of austenitic special steels reduces the heat treatment duration to the region of several seconds to a few minutes. This method – in contrast to overall treatment – offers the possibility of selectively increasing the strength/hardness of areas at risk of failure, while in remaining areas optimum

5 toughness properties are retained.

Mn 1.5 – 4%

Cr 17.5 – 20%

Ni 10 – 13%

N 0.2 – 0.5%

wherein the remainder is substantially composed of iron.

2. Semi-finished and finished products according to claim 1, characterised in that the steel material is inductively precipitation hardened in a zoned manner.
3. Semi-finished and finished products according to claim 1 or 2, characterised in that they are at least partly hardened in a surface layer, wherein the thickness of the precipitation hardened layer is less than 50%, preferably less than 30% and in particular less than 10% of the material thickness measured perpendicular to the surface.
4. Semi-finished and finished products according to one of claims 1 to 3, characterised in that they are either sheets or profile rods with a substantially constant cross-section over their length.
5. Semi-finished and finished products according to claim 4, characterised in that the profile cross-section is circular, elliptical, quadratic, hexagonal, octagonal, L-shaped, cross-shaped, U-shaped or double T-shaped.

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6. Semi-finished and finished products according to claim 6, characterised in that the steel material is a sheet or a plate with substantially constant material thickness.
- 5 7. Finished product according to one of claims 1 to 3, characterised in that it is a shaft with a diameter that varies along its axial length.
8. Method for manufacturing semi-finished and finished products from corrosion-resistant, precipitation hardenable austenitic special steel with a high interstitially dissolved nitrogen content, characterised in that a steel material  
10 with the following chemical composition is firstly manufactured:
 

C	0.082 – 0.115%
Mn	1.5 – 4%
Mo	0.3 – 1.5%
Cr	17.5 – 20%
15 Ni	10 – 13%
N	0.2 – 0.5%

wherein the remainder is substantially composed of iron, in that the material worked in the still hot, or re-heated state into semi-finished and finished products with a substantially smooth surface, and as required can also be cold-  
20 worked, and in that subsequently a precipitation hardening treatment is undertaken that affects at the most a part of the volume of the semi-finished and/or finished products.
9. Method according to claim 8, characterised in that inductive precipitation hardening treatment is undertaken in a temperature range of 300°C to 550°C.
- 25 10. Method according to claim 8 or 9, characterised in that inductive precipitation hardening treatment is undertaken such that the precipitation hardening only occurs in a surface layer with a layer thickness of 0.5 mm at the most.

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11. Method according to one of claims 8 to 10, characterised in that the material is substantially endless material or rod material or respectively sheet material that is passed continuously through an induction apparatus.
- 5 12. Method according to one of claims 8 to 10, characterised in that instead of inductive treatment, precipitation hardening is done by laser irradiation.

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12. Method according to claim 10 or 11, characterised in that inductive precipitation hardening treatment is undertaken such that the precipitation hardening only occurs in a surface layer with a layer thickness of 0.5 mm at the most.
13. Method according to one of claims 10 to 12, characterised in that the steel has the following chemical composition (given in percentages by weight):
- |    |                |
|----|----------------|
| C  | 0.082 – 0.115% |
| Mn | 1.5 – 4%       |
| Mo | 0.3 – 1.5%     |
| Cr | 17.5 – 20%     |
| Ni | 10 – 13%       |
| N  | 0.2 – 0.5%     |
- wherein the remainder is substantially composed of iron.
14. Method according to one of claims 10 to 13, characterised in that the material is substantially endless material or rod material or respectively sheet material that is passed continuously through an induction apparatus.
15. Method according to one of claims 10 to 13, characterised in that instead of inductive treatment, precipitation hardening is done by laser irradiation.



(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES  
PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum  
Internationales Büro



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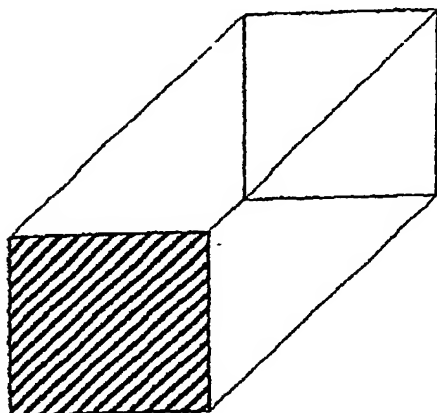
**Veröffentlicht:**

- Mit internationalem Recherchenbericht.
- Vor Ablauf der für Änderungen der Ansprüche geltenden  
Frist; Veröffentlichung wird wiederholt, falls Änderungen  
eintreffen.

Zur Erklärung der Zweibuchstaben-Codes, und der anderen  
Abkürzungen wird auf die Erklärungen ("Guidance Notes on  
Codes and Abbreviations") am Anfang jeder regulären Ausgabe  
der PCT-Gazette verwiesen.

(54) Title: SEMIFINISHED AND FINISHED PRODUCTS MADE OF AUSTENITIC SPECIAL STEEL AND METHOD FOR  
THE PRODUCTION THEREOF

(54) Bezeichnung: HALBZEUGE UND FERTIGPRODUKTE AUS AUSTENITISCHEM EDELSTAHL UND VERFAHREN ZU  
DEREN HERSTELLUNG



(57) Abstract: The invention relates to semifinished and finished products made from special corrosion-resistant precipitation-hardened austenitic steel containing a large amount of interstitially dissolved nitrogen, comprising substantially smooth surfaces. The invention also relates to a method for producing corresponding semifinished and finished items. The aim of the invention is to produce semifinished and finished items and to provide an economical method for the production thereof, combining both solidity and resistance to corrosion. This is achieved by precipitation-hardening areas of the steel material.

(57) Zusammenfassung: Die vorliegende Erfindung betrifft Halbzeuge und Fertigprodukte, hergestellt aus korrosionsbeständigem ausscheidungshärtbaren austenitischen Edelstahl mit einem hohen Gehalt an interstitiell gelöstem Stickstoff, mit im Wesentlichen glatten Oberflächen. Ebenso betrifft die vorliegende Erfindung auch ein Verfahren zur Herstellung entsprechender Halbzeuge und Fertigprodukte. Um Halbzeuge und Fertigprodukte sowie ein Verfahren zu deren Herstellung zu schaffen, die bei preisgünstiger Herstellung

eine besonders günstige Kombination von Festigkeit und Korrosionsbeständigkeit erzielen, wird erfindungsgemäß vorgeschlagen, daß das Stahlmaterial zonenweise ausscheidungsgehärtet ist.

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Germany	299 14 269.8	19 August 1999	YES <u>X</u> NO
Germany	299 14 802.5	24 August 1999	YES <u>X</u> NO
Germany	299 16 517.5	15 September 1999	YES <u>X</u> NO
Germany	299 21 121.5	1 December 1999	YES <u>X</u> NO
Germany	299 21 813.9	12 December 1999	YES <u>X</u> NO

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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